PORTABLE WORKSTATION COMPUTER

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[0001] This application is a divisional application of application no. 09/746,317, filed on 12/22/2000, which claimed the benefit of the provisional application accorded serial no. 60/177,935 and filed on 1/25/2000 in the United States Patent and Trademark Office.

BACKGROUND

[0002] Designers, engineers, animators, digital video editors, digital content creators and other technical professionals use the highest performance PC technology available and the most demanding computer graphics and imaging software applications. The most demanding applications typically can not run or perform adequately on conventional notebook style PC's, a trend that is likely to continue as applications continually raise their minimum requirements. These applications usually require the maximum available processor performance, physical memory sizes 4 to 8 times those available on notebooks, disk performance 5 times that of notebooks, display resolutions of at least 1280 x 1024, and professional 3D graphics using OpenGL which do not exist at all on today's notebook computers. The best performance typically requires at least 10 to 20 times the energy delivered from the present battery technology. Despite the fact that computer technology is constantly evolving and improving, distinctions between the performance and capabilities of what is commonly referred to as a "notebook PC" and what is commonly referred to as a "workstation" remain. Tower-style chassis and CRT-based

display monitors of the typical workstation typically together weigh 100 pounds or more and require high-volume packing materials. As a result, the portability of such systems is limited.

[0003] Today's technical professionals can, and often do, work at home, away on business and outside normal business hours. Because they require access to their high performance computer and their application software, many companies are even providing duplicate home computer systems for their design engineers, analysts, and animators in order to increase overall productivity. Having duplicate systems does not address the need for high performance PC workstations while traveling, or for spontaneous use at the client's site.

[0004] Other professionals require both a full-featured workstation and a notebook PC. The professional still performs all of his or her power-intensive, technical work on the full-featured workstation, but requires the mobility of the notebook to fulfill the minimum office automation needs of the professional working away from the office, such as email and word processing. As a result, the professional must purchase two computers rather than one, and much of the heavy technical work must wait until he can return to the office. The notebook PC does not solve the portability problem for the technical professional.

[0005] Specifically, a mobile technical professional has the following needs in a workstation-class computer: Carry the design process to the client and complete the

work on site; bring live computer models of the project to a prospect client for an interactive sales presentation; demonstrate high-end software products and capabilities on a sales call; continue to do complex design after working hours at home (without a duplicate workstation); use the same computer for every task in the office, at home and on the road; have a truly portable workstation, rugged enough to withstand the bumps and jolts of travel.

[0006] There have been some efforts to provide technical professionals with portable systems for field use, but all such attempts have had significant compromises on the design of keyboard and pointer technology, graphics technology, display performance, and level of integration. For example, display sizes have been limited and designed without regard to component shock protection. In general, these products have not been designed to meet the specific demands of the design professional. Such efforts have focused on a transportable on-the-run computer with some full-size computer features, rather than a high performance workstation without compromise while at the same time being easily transportable.

[0007] In part, the compromises in performance of prior art machines is attributable to the absence of certain enabling technology, which has become available only recently. Such technology includes large high brightness 17" and 18.1" (viewable area) LCD flat-panel display technology with resolutions of 1280 x 1024 or higher and supporting 24-bit per pixel true color images; digital video interface standards allowing high speed digital connections to such panels; and best-of-class 3D graphics technology using the above

digital video interface standards suitable for use in high-end 3D applications. The advent of these building blocks, however, has not solved the problems of portability and durability. A new mechanical package, which is both portable and durable, is needed.

[0008] Moreover, as with any product, cost must be reasonable, and this is only possible using standard available workstation components. These standard components, such as the disk drive, the processor module and motherboard are designed for use in the relatively immobile environment of the tower-style chassis. They are not designed to withstand the acceleration forces and vibrations which a portable system must endure. Shock management systems are needed to ensure that the portable workstation is robust and secures the safe transport of important data as well as expensive computer components. Power supplies, high performance processors and other components usually generate significant heat and require adequate ventilation. In addition, the system must be impact resistant and dust tolerant. As with all computer products, it should be easy to service, flexible for popular options, quiet, attractive, and ergonomically designed for the user.

[0009] Thus, there exists a need for a truly portable, high performance workstation computer, of reasonable cost, which will allow the technical professional to perform computer-intensive design, modeling, and presentation work without regard to location; which will withstand the environment of the field; and which will satisfy the serviceability, flexibility, and ergonomic requirements of the technical professional.

SUMMARY

[0010] The present invention satisfies these needs by providing novel modular packaging and a shock resistant mechanical housing for a workstation computer designed to meet the specific needs of professional power users. The system meets the performance specification of high performance workstations, but with a volume of approximately 1 cubic foot and a weight of less than 35 pounds in a preferred embodiment. It is rugged enough to transport as a brief case, be carried on an airplane, and checked as ordinary luggage. The system is designed to be a full-featured performance workstation which can be set up on the desktop similar to any other workstation, but with the ability to completely pack up and travel with the user in a matter of minutes. The system requires AC power of approximately 150 watts and provides high end workstation-class display, keyboard, disk, memory, and graphics performance. It is, in fact, a full-featured workstation with the added benefit of being small and light enough to pack and carry anywhere a brief case can be taken.

[0011] In a preferred embodiment, the invention comprises the processing, storage, and input/output components of a workstation computer transported and housed in removably attachable sections. These sections include a display assembly comprising a display and a display frame having a front face and a back face, with the display mounted in the display frame; a frontal concave member having a rearward opening adapted to mate with the front face of the display frame; a rearward concave member having a frontal opening adapted to mate with the back face of said display frame, the rearward member comprising a mounting plate attached thereto proximate its opening, whereby an

enclosure is formed in which the processing, storage, and input/output components are mounted. The display assembly may be interposed between the frontal concave member and the rearward concave member, forming a casing for the computer.

[0012] Further, the embodiment includes a first and second fastening means, preferably comprising spring-biased threaded pins, and gates slidably mounted to the rearward concave member. The rearward concave member has portals in its side walls which are alternatively revealed and enclosed as the gates slide from an extended position to a retracted position. The first fastening means allow for securing and releasing the first end cap to the display assembly, and also for attaching the display assembly to the slidable gates. Each gate may include a cam cut which is engaged by a pin of the first fastening means acting as a cam follower, allowing for variable placement of the display assembly. The second fastening means allows for securing and releasing the slidable gates, which move from a retracted position, in which they act as dust covers for input/output devices and connectors within the rearward concave member, to an extended position, in which they act as a stand for the display. With the gates in the extended position, the input/output devices and connectors are accessible through the portals in the side walls of the rearward concave member. The mounting plate, to which the motherboard and other elements of the computer subsystem are attached, may be affixed to the rearward concave member through shock isolators. The preferred embodiment may further include conductive material located on the rearward concave member and in contact with the mounting plate to act, in conjunction with the member itself, as an EMI shield when the system is assembled. Preferably, the conductive material is resilient and

tubular in shape, forming a gasket, such that it also functions as a dampener to absorb vibrations, halt any oscillations of the shock isolators described above, and thus further protect the electronic components.

DESCRIPTION OF THE DRAWINGS

[0013] These and other features, aspects, structures, advantages, and functions are shown or inherent in, and will become better understood with regard to, the following description and accompanied drawings where:

[0014] Figure 1 is a perspective view of an embodiment of the present invention in an unpacked and ready-for-use configuration.

[0015] Figure 2 is a perspective, partially broken away view of the device of Figure 1, in a packed up and ready-for-travel configuration.

[0016] Figure 3 is a perspective view of the device of Figure 1, with the first end cap removed, and the display in a retracted position. Figure 3B is a perspective, partially broken away view housing the device with the display in an extended position adjusted to an ergonomic viewing angle.

[0017] Figure 4 is an enlarged perspective view of the mounting bracket of the first end cap shown in Figures 1 and 2, illustrating how the mounting bracket engages the first pin assembly.

[0018] Figure 5 is a rear perspective view of the display assembly of Figure 1.

[0019] Figure 6 is an exploded view of the device of Figure 1.

[0020] Figure 7 is an enlarged view of a portion of the perimeter of the midsection of the device shown in Figure 1.

[0021] Figure 8 is a perspective view of the mounting plate and main board with electronic components installed before assembly into the midsection.

[0022] Figure 9 is a perspective view of a dual-screen embodiment of the present invention, in a packed up and ready-for-travel configuration.

[0023] Figure 10 is a perspective view of the device of Figure 9, with the first end cap removed, showing the elongated mounting brackets of this embodiment.

[0024] Figure 11 is a perspective view of a display stand for the second display panel of the device of Figure 9.

[0025] Figure 12 is a perspective view of the second display of the device of Figure 9 in position on the display stand of Figure 10.

DESCRIPTION OF A PREFERRED EMBODIMENT

[0026] The invention comprises a workstation-class computer housed in modular sections that can be packed up into a briefcase-like configuration for storage or travel and quickly unpacked and configured into an ergonomic workstation computer. In a preferred embodiment, a display assembly is sandwiched between and affixed to frontal and rearward concave members to form a rugged, transportable briefcase. The frontal concave member, also referred to as the first end cap or accessory pack, is capable of housing a keyboard, mouse, and other accessories. The second concave member houses processing, memory, and input/output components. To facilitate accessibility of these components, the second concave member may be comprised of two discreet modules, a midsection and a removable end cap. As described more fully below, in the in-use configuration, the first end cap is removed entirely from the briefcase, revealing the display assembly. The display assembly is adjustably mounted to the second concave member and may be moved into an ergonomic viewing angle for use.

[0027] Figure 1 shows an embodiment of the present invention set up for use with the first end cap 50 removed. Also shown are the display assembly 60, midsection 70, and second end cap 80. The display assembly comprises a display frame 61 and a flat panel display, such as an LCD, 63. The motherboard and other computer components, such as the disk drives, are mounted on a mounting plate 90 (the back of which is shown), which is secured to the midsection 70. The computer components are therefore protected within the enclosure formed by the midsection 70, the second end cap 80, and the mounting plate 90.

[0028] The accessory pack of this embodiment is an approximately 1.75" deep by 18.6" x 13.6" drawn aluminum structure and makes up one side of the brief case when the unit is in its packed up condition. The accessory pack may contain compartments for holding the keyboard, mouse, power cords, and miscellaneous items such as CD media, floppy media, and if needed, an external ZIP or JAZZ disk drive. A rigid flap 52 isolates the contents of the accessory pack from the adjoining flat panel display.

[0029] In Figure 2, the system is packed up into a briefcase size package and is ready to be transported. This embodiment has a weight of less than 35 pounds with dimensions of approximately 19" x 14" x 7.5". As shown, the external perimeter of the display frame serves as part of the external casing when the system is in its packed-up configuration, thus allowing for a maximum size display panel. The mechanical components are constructed from a variety of drawn, extruded, and sheet aluminum. Other materials could be used, such as plastics, titanium, other metals, and composites, and would be well known to those skilled in the art. Aluminum is chosen for its light weight and relatively low cost. In the packed configuration, the external casing covers and encloses electronic components and connectors.

[0030] The accessory pack may be removed from the unit by releasing a first set of pin assemblies 62, which are located on the display assembly 60. As shown in Figure 2, a pair of mounting brackets 56 (only one of which is shown) is affixed to the accessory pack. The display frame has slots on its front side to receive these brackets. The

mounting brackets hold the accessory pack in place when the brackets are inserted into slots on the display and secured by the pin assemblies 62.

[0031] Figure 4 is a detailed view of a preferred embodiment of the pin assembly of the present invention. The assembly comprises an elongate shank or barrel terminating in a knob or handle on one end and a pin or cam follower, of a smaller diameter than the barrel, on the other. The shank is slidably housed within a sleeve or collar (not shown), in which a spring or other biasing means (also not shown) may be used to bias to the shank in its extended position, shown in Figure 4. In that position, the cam follower may extend through and engage the cam cut in the gates, and the larger diameter shank is extended through the mounting bracket 56, fixing it in place. Further, a portion of the shank and housing may be threaded so that the assembly may be tightened into its extended position. By doing so, the end of the larger diameter shank may bear tightly against the area of the gate proximate the cam cut (with the cam follower extending through the cut), such that resultant frictional force fixes the display assembly in place relative to the cam on the gate. When the shank is unscrewed and pulled into its retracted position, the smaller diameter terminal pin is aligned with the mounting bracket 56, allowing the bracket to be separated from the pin assembly, so that the accessory pack may be removed from the display.

[0032] With the accessory pack removed, the system is as shown in Figures 3A and 3B. A pair of gates 74 are slidably attached to the side walls of the midsection. Each gate has a curved front edge, with an aperture therethrough preferably in the form of an

arcuate cam cut, which extends into a second slot on the rear side of the display frame. The first pin assemblies 62 engage this cam cut as described above and thus hold the display in position on the gates. Each gate has at least one other aperture proximate its rear edge, which is engaged by a second set of pin assemblies 72 located in the midsection. Releasing pin assemblies 72 located in the midsection allows gates 74 and the display assembly 60 to slide into their extended position (as shown in Figure 3B), about 1.75" forward of the midsection. The gates may have a small aperture or apertures near their rearward and forward edges, which, when engaged by the pin assemblies 72, fix the gate position. As the gates extend, all media disk drives and all I/O connectors and ventilation holes are revealed through portals in the midsection walls and become accessible. See Figure 1. Such elements including a floppy, CDROM drive, external SCSI connector, and power connector. The display may be placed into an ergonomic viewing position, as shown in Figure 3B, by releasing the first set of pins and sliding the display assembly along the cam 76 in the gates 74 and securing the pins when the display is in the desired position. Thus, the first securing pin assemblies 62 secure the accessory pack 50 to the display frame, act as cam followers in the "J" cam cuts 76, and provide a friction tilt lock by screwing down once the display 60 is in the desired position. A small inverted "J" hook at the top of the cams 76 may be used to provide a stable resting place for the display assembly 60 and associated first securing pins 62 when display is in its normal operating position. The display assembly's center of gravity may be designed to be slightly off the assembly's midpoint, so that the assembly riding in the cam 76 tends towards an off-vertical angle, which is ergonomically preferable.

[0033] The display assembly 60 may be removed entirely from the gates 74 by unscrewing and releasing the pin assemblies 62. The display assembly 60 as removed from the remainder of the system is shown in Figure 5. Note the short slots 64 on the front side of the display frame, which are adapted to accept the mounting bracket 56 of the accessory pack 50. Also note the long slots 66 on the rear side of the display 60, which are adapted to accept the gates 74.

[0034] Figure 6 is an exploded view of the system. Note that one gate 74 is shown in its extended position and the other is shown in its retracted position. In their retracted position, the gates 74 cover and protect I/O devices, ports, and connectors from dust and other environmental hazards, such as rain, mist, or debris (see Figure 2). In their extended position, the gates 74 allow full access to these components (see Figure 1). A plurality of supports 78 and shock isolators 79 are shown. The supports 78 attach to a reinforcement extrusion on the midsection for stability. Standoffs on the mounting plate 90 are attached to the supports 78 through the shock isolators 79. Thus, the computer subsystem secured to the mounting plate 90 floats on numerous shock isolators 79 providing important protection against rough handling and accidents. The shock isolators 79 may be made of a shock absorbent polymer or similar flexible, resilient, and dampening material, and they provide the mounting plate 90 approximately .1" of free travel in each direction before hard contact with the midsection.

[0035] Figure 7 is an enlarged view of a portion of the midsection revealing a small EMI gasket 100 fitted into a groove in the perimeter of the midsection. A similar groove

and gasket (not shown) are located on the perimeter of the underside of the midsection. The edges of the mounting plate 90, when it is secured to the supports 78 as described above, contact the small EMI gasket 100. Similarly, the perimeter of the second end cap 80 comprises a lip 82, which is adapted to mate with the groove 75 on the underside of the midsection and snug securely against the second small EMI gasket 100. Large EMI gaskets 104 are placed proximate each of the corners of the midsection. Similarly, large EMI gaskets 106 transverse the second end cap, in alignment with gaskets 104 (see Figure 6). The large EMI gaskets 104 and 106 are adhesively fastened to the midsection and second end cap, respectively, and are positioned to engage the perimeter of orthogonal wings 91 (see Figure 8) of the mounting plate 90 when the unit is assembled. As a result, when assembled the entire perimeter of the mounting plate 90 is in constant contact with EMI gaskets, which are of a conductive material, forming an effective EMI cage in conjunction with the aluminum end cap and midsection.

[0036] The EMI cage thus formed serves a second function. In addition to being conductive, the EMI gaskets 100, 104, and 106 are made of a resilient material, and preferably are tubular in cross-section. These characteristics seal and unitize the assembled second end cap, midsection, and mounting plate. Their resilient nature causes the gaskets to the act as dampeners and thus further isolate the mounting plate and associated electronics from vibrations. In addition, the gaskets limit the travel of the mounting plate on the shock isolators 79 and critically dampen oscillations or resonant vibrations from this movement. In combination, the shock isolators and EMI gaskets provide a high level of protection from vibration, which allows for the use of standard

workstation components. Further, the orthogonal wings, which may be made of thin sheet of perforated aluminum, serve a shock-absorbing function. If the machine is struck by a significant force which fully compresses the shock isolators 79 and EMI gaskets, the force is passed into the wings which may deform or even crumple as they absorb the force. This deformation of the easily replaced mounting plate may save the more expensive computer components from a mechanical shock-related failure.

[0037] Figure 8 shows several significant computer subsystem components, which are mounted to mounting plate 90. The main board (or motherboard) 92 mounts to the plate 90 with screws connecting to standoffs pressed into the plate 90. The plate 90 may have selectively located ventilation holes for facilitating air flow to specific motherboard components. By way of example and not of limitation, the computer subsystem includes the following components (though not all are illustrated): motherboard 92 including dual Pentium microprocessor modules, memory sockets and standard I/O including parallel port, 2 serial ports, 2 USB ports, stereo IN/OUT, PS/2 connections for keyboard and mouse, 10/100 Ethernet (RJ45 connector); dual channel Ultra2 SCSI controller and connectors; dual EIDE controller and connectors; disk drive stack 95 including mounting bracket, LS-120 super floppy, CD or DVD disk, SCSI hard disk, interconnect back-plane for LS-120 and CD or DVD drive; power supply 98; dual cooling fans 96; PCI/AGP riser card stack assembly 94 consisting of PCI right angle riser, AGP right angle riser, fasteners, AGP graphics card, and user supplied PCI card (optional). It is understood that computer technology is rapidly developing and advancing, and these components are simply exemplary of a preferred embodiment. They are detailed here to emphasize the

full-featured nature of the computer subsystem of this embodiment of the present invention.

[0038] A dual screen embodiment is shown in Figures 9 and 10. In this embodiment, as shown in Figure 10, the mounting brackets 56 are longer and extend through the second display unit 65 and into the first display unit 60, allowing the securing pins in each display assembly to engage the brackets when the unit is in its packed-up configuration. A stand 110 is shown in Figure 11, which may be disassembled and transported in the accessory pack. As shown in Figure 12, the second display and accessory pack form an A-frame which is held in position by the pin assembly of the second display engaging the mounting bracket of the accessory pack. This A-frame may be placed on the stand 110 for viewing. The stand 110 is sized to allow the second display to be positioned next to and in alignment with the first display for optimal viewing. The base of the external case may also include a threaded female recess sized to accept a standard camera mount, such as on a tripod, thus allowing the entire unit to be elevated for presentations and the like.

[0039] Although the present invention has been described and shown in considerable detail with reference to certain preferred embodiments thereof, other embodiments are possible. The foregoing description is therefore considered in all respects to be illustrative and not restrictive. For example, the lessons taught in the specific design set forth above are generally applicable for systems both larger, incorporating 21.3" flat panel displays (and even larger displays, yet to be developed), and smaller, using 15"

display components. It should also be understood that even in the single screen embodiment, the display may be detached and mounted on an external stand as desired by the user. The second end cap and midsection may be joined together in one integral module. Upon reading the foregoing disclosure, this and other variations would be apparent to those skilled in the art. Therefore, the present invention should be defined with reference to the claims and their equivalents, and the spirit and scope of the claims should not be limited to the description of the preferred embodiments contained herein.